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Fellows

MACHINES
CUTTERS
TOOLS

THE FELLOWS GEAR SHAPER COMPANY, SPRINGFIELD, VERMONT, U.S.A.

FELLOWS

FELLOWS

MACHINES, CUTTERS, AND TOOLS

In the following pages are presented a few of the many possible applications of Fellows Cutters and Gear Shapers, which will serve to illustrate that the Fellows Method is capable of wide application. The Gear Shaper Cutter can be made in a variety of shapes and sizes to operate both externally and internally, and to produce plain and irregular outlines.

In addition to the cutting of external and internal spur, helical and herringbone gears, the Gear Shaper Cutter can also be applied to the cutting of roller and silent chain sprockets; external and internal ratchets; external and internal splines, both involute and straight-sided; interrupted-tooth gears; segment gears; cams; elliptical gears; square and hexagon surfaces; face gears, and clutches; worm threads; and, in fact, to practically every conceivable shape.

Several methods of applying the cutter to the work are also possible. With the regular cutter, gear teeth and other forms are generated by feeding the cutter into depth at the same time that the cutter and work are rotating in unison. The gear is sometimes rough cut with one cutter, and finish cut in another operation with a finishing cutter.

A type of cutter known as the "series-gap" operates in a different manner. This cutter differs in design and application from the regular cutter in the following respects.

1. A single cutter in all cases is used for both rough and finish cutting, irrespective of the pitch.
2. The cutter is made with a multiple of the number of teeth on the work.
3. The roughing teeth are made to different thicknesses, and sometimes lengths, to divide the amount of material removed between roughing and finishing groups of teeth.
4. The saddle remains in a fixed position during roughing and finishing cuts.
5. The cutter is rotated into depth, instead of being fed in radially.

On work to which this type of cutter can be applied, the results are: greater accuracy, higher production, and lower costs.

Other types of gap cutters are made for cutting segment gears and work having projections, the gap clearing the projection on the work. In these cases, as a rule, the cutter does not make a complete revolution, the Gear Shaper being arranged with a "kick-off" and reversing attachment. Form cutters are also made for producing splines, etc., where a generating cutter cannot be used, in which case the Gear Shaper fulfills the function of a slotting machine, and is provided with an intermittent indexing mechanism.

Starting with a single machine in 1897, the Gear Shaper line now includes many sizes and types of machines, each being particularly suited to certain classes of work. For instance, two new machines have recently been developed for cutting small, fine-pitch gears for use in clocks, meters, motion picture cameras and projectors, etc. These machines will cut gears as small as $\frac{1}{16}$-inch in diameter, and as fine as 200 pitch to a degree of accuracy, and on a production basis, that heretofore has not been possible. Contrast these miniature machines with a Gear Shaper having a capacity for gears up to 100 inches diameter and 2 diametral pitch, and you have some idea of the range of the Fellows Method.

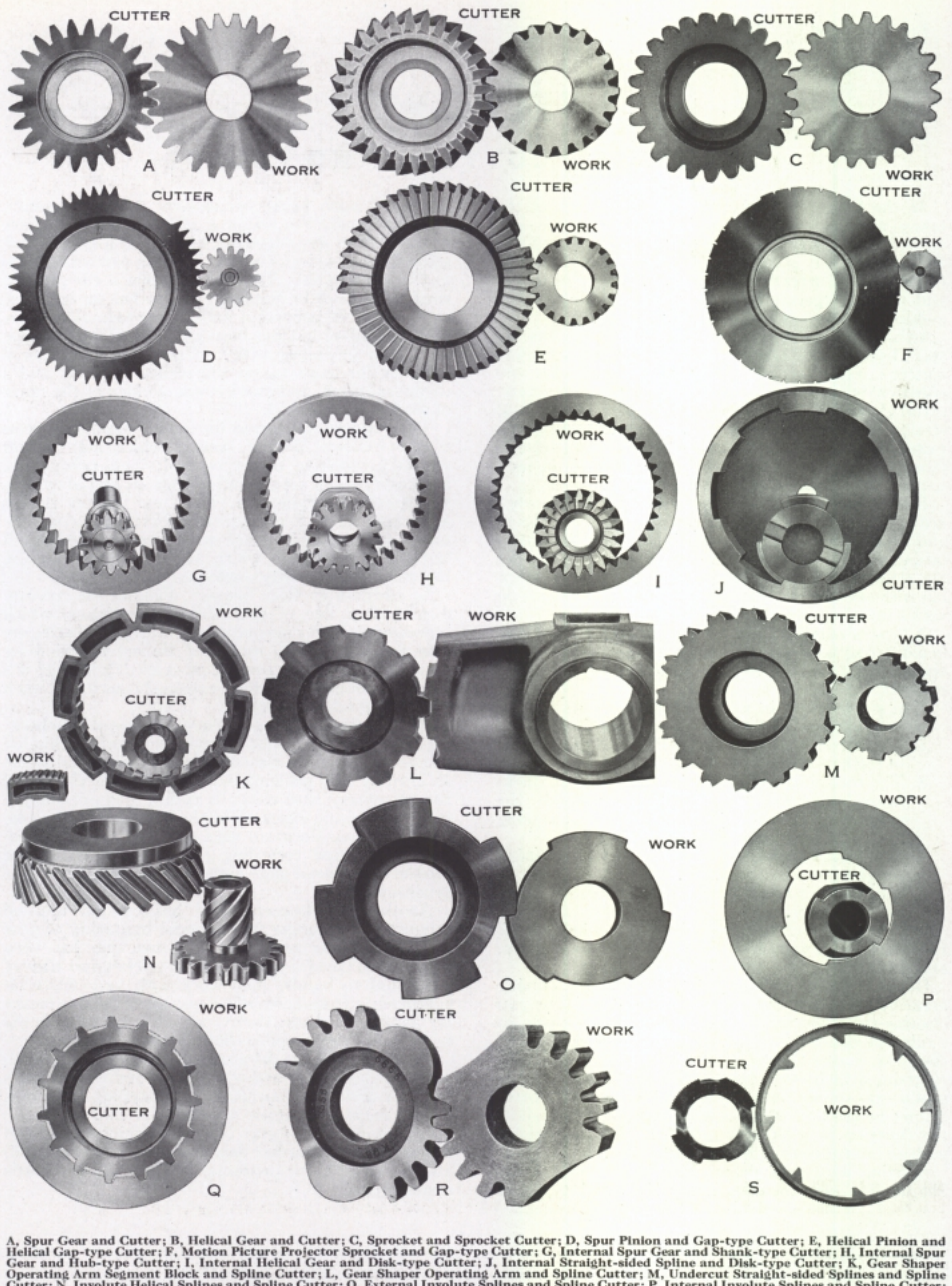
There are many reasons for the outstanding success of the Fellows Method, among which are: greater accuracy; positive cutter control; high production; low cost; ease of set-up and operation; and above all, versatility of application. The Gear Shaper is also admirably suited to the addition of fixtures and attachments to increase its range of application, enabling it to perform operations which would ordinarily require the use of a more costly single-purpose machine.

In addition to Gear Shapers, Fellows has recently developed a line of gear shaving machines, which represent an important advance in the art of accurate gear finishing. These machines are not intended for removing any great amount of stock, their chief advantage being to produce extremely accurate work on a high-production basis.

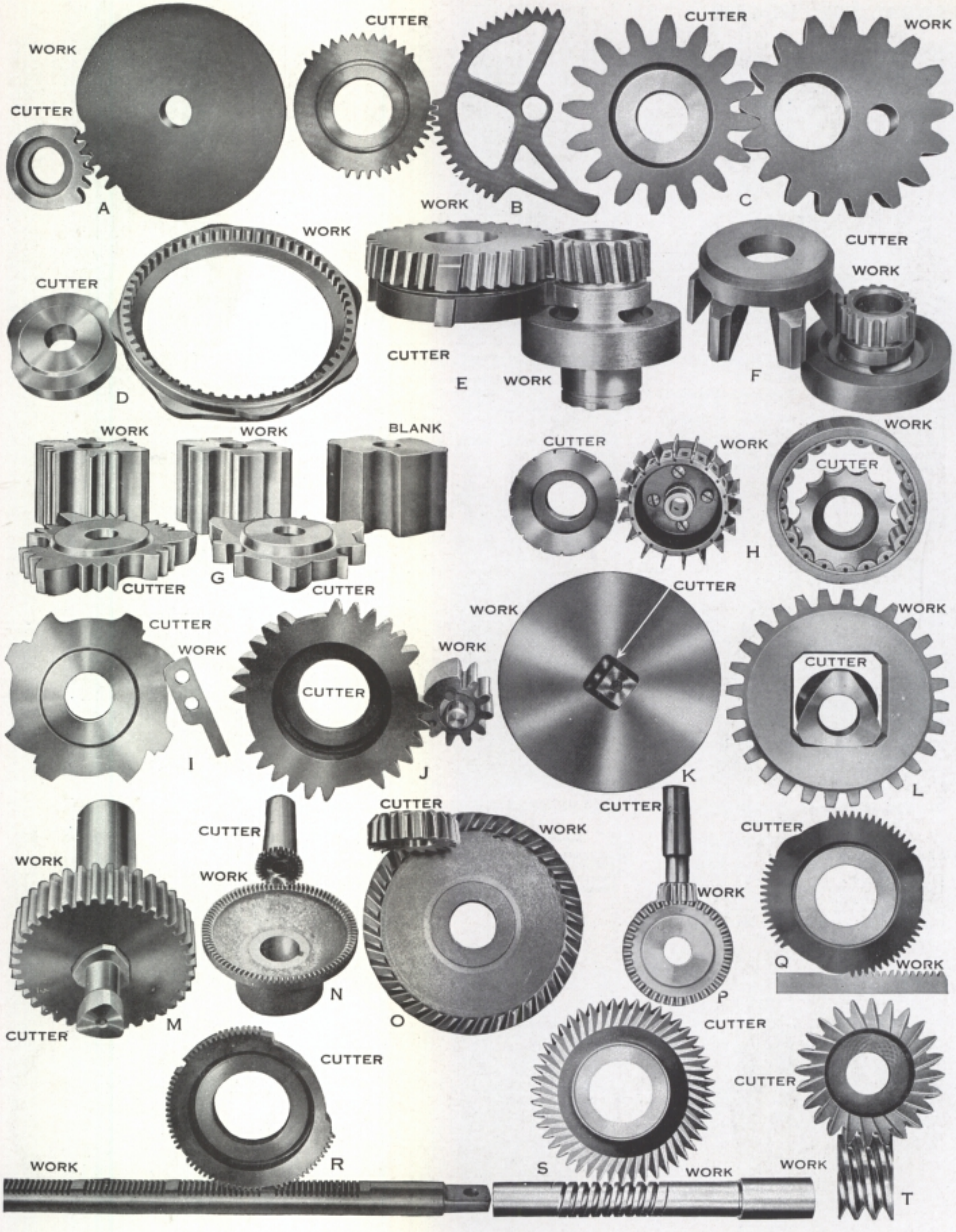
Further developments include equipment for checking gears and gear tooth elements. Heading this list is a line of involute measuring machines operating on an entirely new principle which eliminates the use of the customary base rolls. In addition to providing a means for visual checking of the accuracy of the profile, these machines are also arranged with an electrically operated recording device for charting the profile. The visual gage and the recording device are synchronized.

Another development that has created unusual interest is a machine for the local hardening of gear teeth and other members. This machine has been designed to cover a wide range of pitches and sizes of gears and to handle such work with very universal equipment. It also provides a quick and reliable means for handling a large variety of other parts with the minimum of time required for changing the set-up.

In addition to the developments outlined, there are other machines for cutting, finishing and testing gears together with: gear burnishing and lapping machines; worm thread generators; machines for charting gears; also Shaving Tools; gear laps; burnishing gears, and master gears. Complete descriptive literature is available on all of these products, and will be sent gratis upon request.

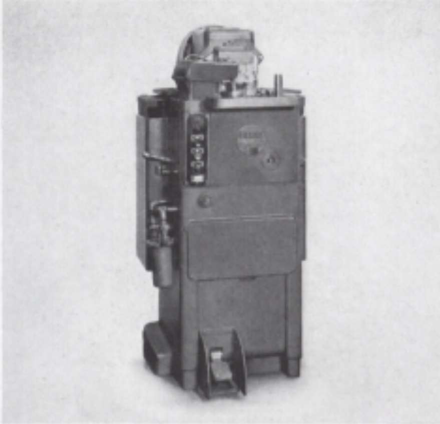


A, Spur Gear and Cutter; B, Helical Gear and Cutter; C, Sprocket and Sprocket Cutter; D, Spur Pinion and Gap-type Cutter; E, Helical Pinion and Helical Gap-type Cutter; F, Motion Picture Projector Sprocket and Gap-type Cutter; G, Internal Spur Gear and Shank-type Cutter; H, Internal Spur Gear and Hub-type Cutter; I, Internal Helical Gear and Disk-type Cutter; J, Internal Straight-sided Spline and Disk-type Cutter; K, Gear Shaper Operating Arm Segment Block and Spline Cutter; L, Gear Shaper Operating Arm and Spline Cutter; M, Undercut Straight-sided Splines and Spline Cutter; N, Involute Helical Splines and Spline Cutter; O, External Involute Splines and Spline Cutter; P, Internal Involute Splines and Spline Cutter; Q, Internal Clutch and Side-Trimming Cutter; R, Geneva Stop and Special Cutter; S, Pawl for a Rifle Sight and Gap-type Cutter-Ring is subsequently cut into segments.



A, Segment Gear and Cutter; B, Segment Gear for Cash Register and Cutter; C, Elliptical Gear and Cutter; D, Cam for Aeroplane Engine and Cutter; E, Clutch Gear for Automobile Transmission and Two Cutters; F, Six-prong Cutter for Forming Involute-sided Clutch Slots; G, Gear for a Bilge Pump and Cutter; H, Rotors for Refrigerator Compressor and Cutters; I, Rachet for Basket-making Machine and Cutter; J, Gap-type Cutter and Door-closing Pinion; K, Square Hole and Square Cutter; L, Square Hole and Three-cornered Cutter; M, Three-cornered Hole and Roughing and Finishing Three-cornered Cutter; N, Face Clutch and Shank-type Cutter; O, "Off-Center" Face Gear and Cutter; P, "On-Center" Face Gear and Shank-type Cutter; Q, Combined Rack and Cam and Cutter; R, Interrupted Spur Tooth Rack and Cutter; S, Straight-sided Worm Produced by 'In Feed" and Thread Generating Cutter; T, Straight-sided Worm and Thread Generating Cutter.

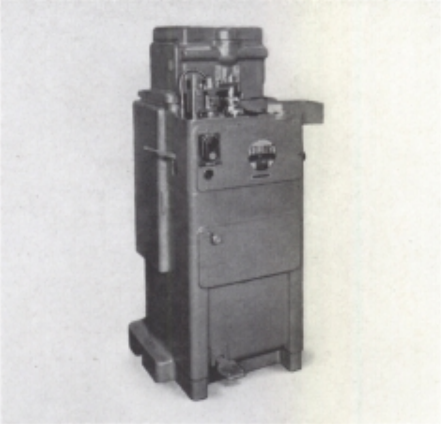
FELLOWS GEAR SHAPERS



STRAIGHT-LINE GEAR GENERATOR

For cutting External Fine-pitch Gears

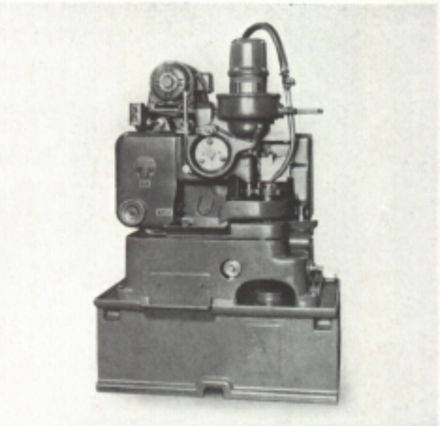
Maximum Capacities:
Pitch diameter........1½″ Spur, 1″ Helical
Face width, Spur and helical............¾″
Diametral Pitch: 30, Free-cutting brass; 32 other non-ferrous materials; 40 Free-cutting steel. Cap. for helical gears depends on pitch.



3-INCH FINE-PITCH GEAR SHAPER

For cutting External and Internal Fine-pitch Gears

Maximum Capacities—Spur and Helical Gears
Pitch diameter..............Ext. 3″ Int. 2″
Face width.............................¾″
Diametral Pitch: Same as Straight-Line Gear Generator
Helix angle............................45°



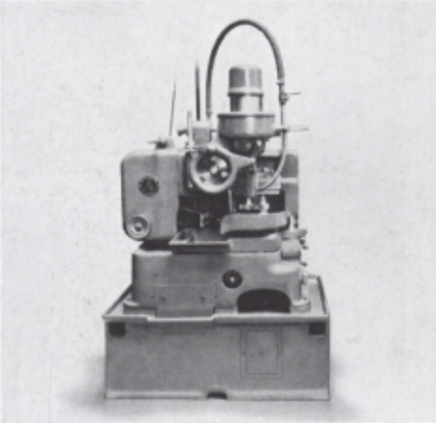
7-TYPE SPUR HIGH-SPEED GEAR SHAPERS

For cutting Spur Gears

Maximum Capacities:

	Ext. Nos. 7 & 71	Int. Nos. 72 & 712
Pitch diameter	7″	5½″
Face width	1½″	1″
Diametral pitch	6	8

Cap. Nos. 72 & 712 for ext. gears, same as 7 & 71



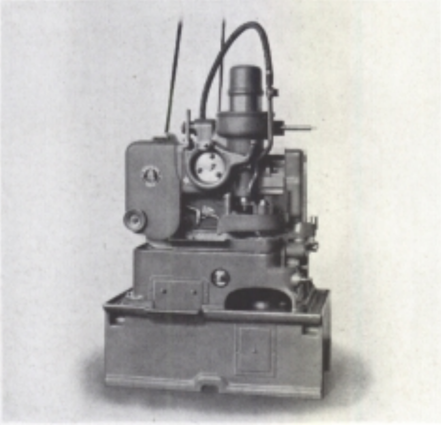
7-TYPE HELICAL HIGH-SPEED GEAR SHAPERS

For cutting Helical Gears

Maximum Capacities:

	Ext. Nos. 75 & 715	Int. Nos. 725 & 7125
Pitch diameter	6½″	5½″
Face width	1½″	1″
Diametral pitch	6/8	6/8
Helix angle		45°

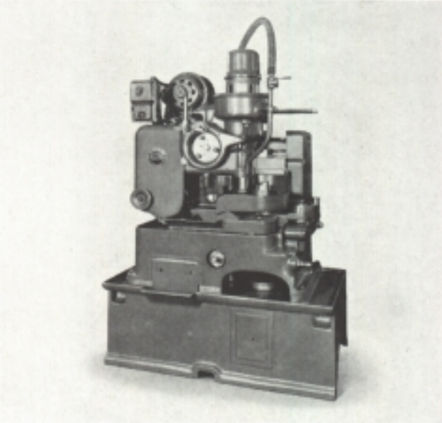
Cap. for Spur same as Spur Machines.



7A-TYPE SPUR HIGH-SPEED GEAR SHAPERS

For cutting External Spur Gears

Maximum Capacities:	Ext. Nos. 7A & 71A
Pitch diameter	7″
Face width	2″
Diametral pitch	5/7

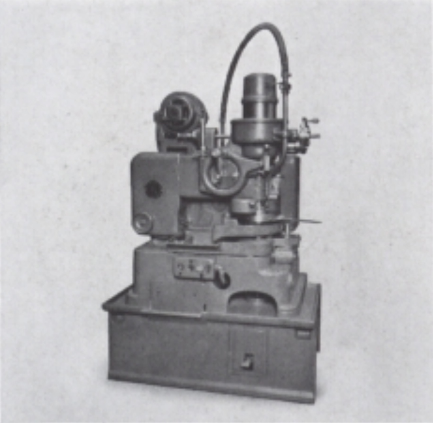


7A-TYPE HELICAL HIGH-SPEED GEAR SHAPERS

For cutting External and Internal Helical Gears

Maximum Capacities:

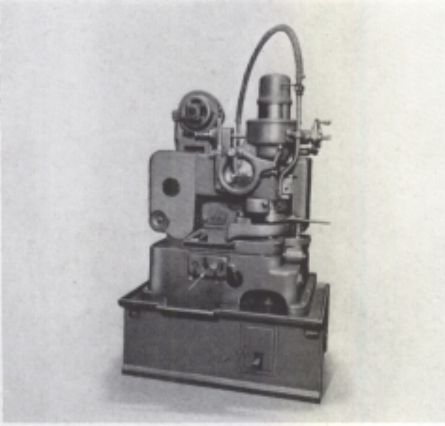
	Ext. Nos. 75A & 715A	Int. Nos. 725A & 7125A
Pitch diameter	7″	5½″
Face width	2″	1½″
Diametral pitch	6	6
Helix angle	45°	45°



77-TYPE HIGH-SPEED GEAR SHAPERS

For Side-trimming Internal Clutch Teeth

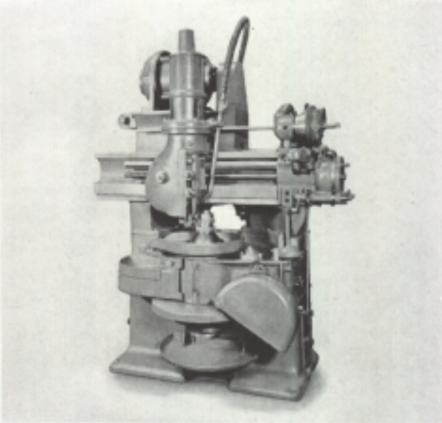
Maximum Capacities:
Internal pitch diameter..................4″
Face width—Depending on design of clutch
Diametral pitch, Spur....................8
No. 775 Helix Angle 45°, Pitch 8/10



77A-TYPE HIGH-SPEED GEAR SHAPERS

For Side-trimming Internal Clutch Teeth

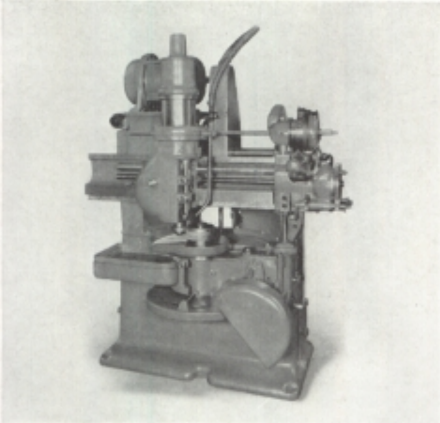
Maximum Capacities:
Internal pitch diameter..................5″
Face width—Depending on design of clutch
Diametral pitch, Spur....................8
No. 775A Helix Angle 45°, Pitch 8/10



6-TYPE SPUR GEAR SHAPERS

For cutting External and Internal Spur Gears

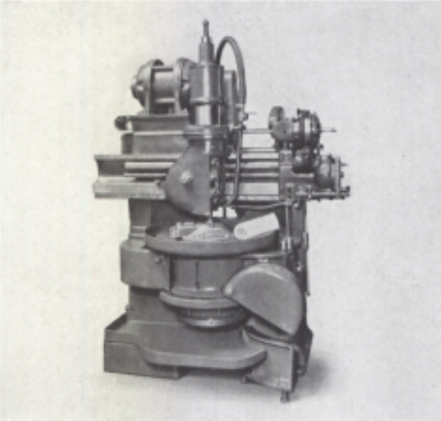
Maximum Capacities:
Pitch diameter............Ext. 35″ Int. 25″
Face width.................Ext. 5″ Int. 3″
Diametral pitch, Nos. 61, 64..............4
Diametral pitch, Nos. 62, 612.............¾



6-TYPE HELICAL GEAR SHAPERS

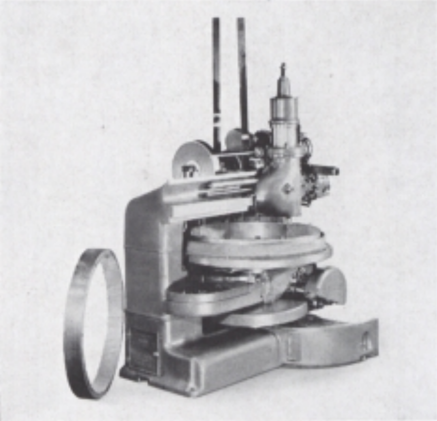
For cutting External and Internal Helical Gears

Maximum Capacities:
Pitch diameter............Ext. 35" Int. 24"
Face width.................Ext. 5" Int. 3"
Diametral pitch..........................5/7
Helix angle (with S't'd Guides)..........30°
Capacity for Spur Gears same as Spur Machines.



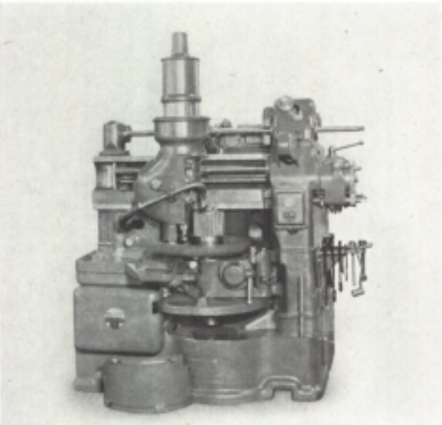
6-TYPE, MODEL-Z GEAR SHAPERS

Capacities are similar to regular 6-type machine, except for diameter of shank gears which can be accommodated. Machines Z-1 & Z1-5 have 11½" hole. Machines Z-2 & Z2-5 have 16" hole. Z-1 & Z-2 for spur gears. Z1-5 & Z2-5 for helical and spur gears.



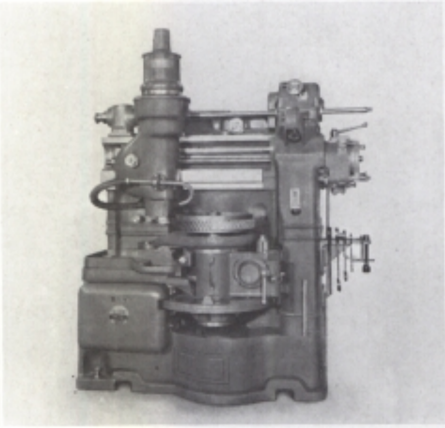
6-TYPE, MODEL-Y GEAR SHAPERS with Elongated Bed

Maximum Capacities:
Pitch diameter External 4" cutter........36"
Pitch diameter Internal 4" cutter........43"
Face width..................6" Ext. 5" Int.
Machine Nos. 64-Y for spur gears, 645-Y for spur or helical gears.



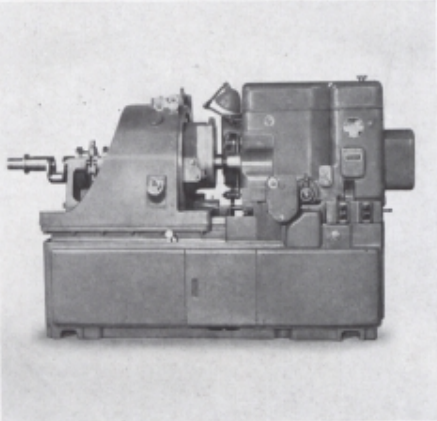
6A-TYPE GEAR SHAPERS

Maximum Capacities:
Pitch diameter, External or Internal.....18"
Face width..................Ext. 5" Int. 3"
Diametral pitch........Spur ¾ Helical 5/7
Helix Angle (with s't'd guides)..........30°
Spur Machines Nos. 61A, 612A, 64A, 624A
Helical Machines Nos. 615A, 645A.



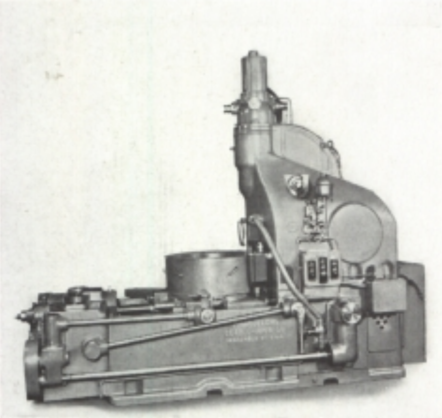
6A3-TYPE GEAR SHAPERS

Maximum Capacities:
Pitch diameter, External or Internal.....18"
Face width, External or Internal..........3"
Diametral pitch........Spur ¾ Helical 5/7
Helix angle (with s't'd guides).........30°
Spur Machines: Nos. 62A3, 624A3
Helical Machines: Nos. 65A3, 645A3



HORIZONTAL Z-MODEL GEAR SHAPER

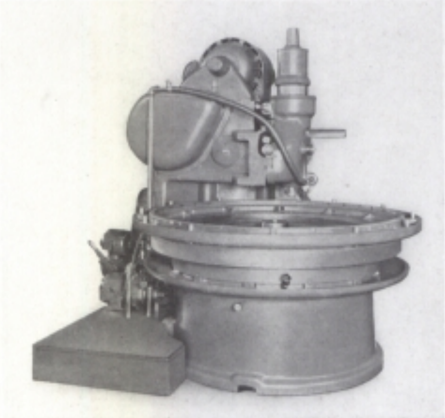
Maximum Capacities:
Movement of work-slide................19"
Movement of cutter slide...............6½"
Pitch diameter, External with 5" cutter..8"
Pitch diameter, Internal governed by diameter of cutter. Designed for cutting splines in Aeroplane Engine Crankshafts.



NO. 30 GEAR SHAPER

For External and Internal Spur Gears

Maximum Capacities:
Pitch diameter............Ext. 40" Int. 34"
Face width...............................8"
Diametral pitch.............................2
Minimum Internal pitch diameter......14"

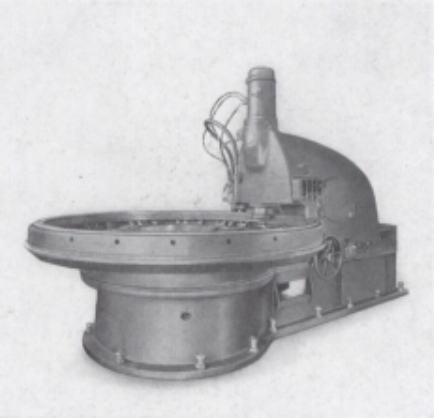


48-INCH GEAR SHAPER

For Internal Spur and Helical† Gears

Maximum Capacities:
*Pitch diameter, Internal.......48", 60", 72"
Face width..............................6"
Diametral pitch........................4/5
Minimum pitch diameter...............28"

*with bed in three positions
†with special saddle

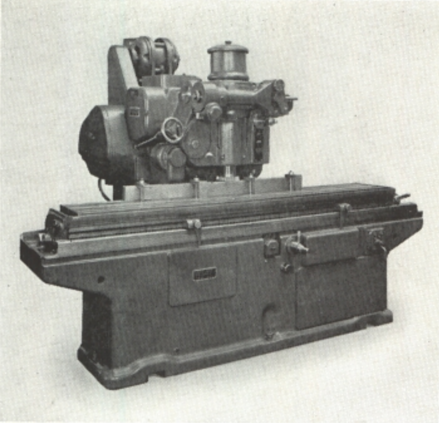


100-INCH GEAR SHAPER

For External and Internal Spur Gears

Maximum Capacities:
Pitch diameter, External or Internal....100"
Face width...............................6"
Diametral pitch............................2
Minimum pitch diameter. Ext. 28" Int. 46"
Depending on pitch and design of gear.

FELLOWS RACK SHAPERS; THREAD GENERATOR; GEAR SHAVING, AND LAPPING MACHINES

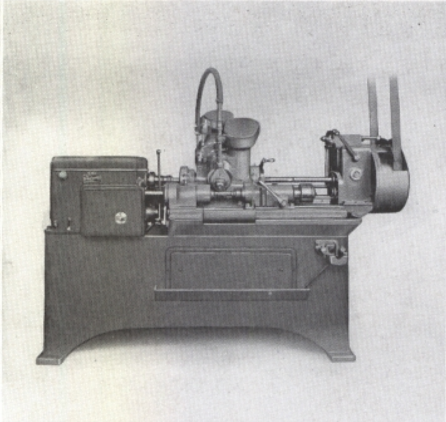


NO. 3-60 RACK SHAPER

For Spur and Helical Racks

Maximum Capacities:	
*Rack length	60″
Face width	3″
Diametral pitch	Spur 4 Helical 5
Helix angle (with s't'd guides)	30°

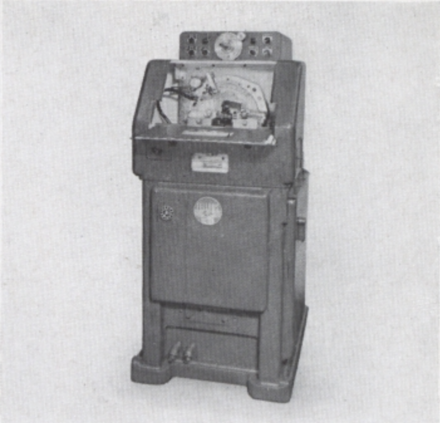
*Can be increased to 72″ for certain types of racks.



NO. 4-THREAD GENERATOR

For Worms and Threads

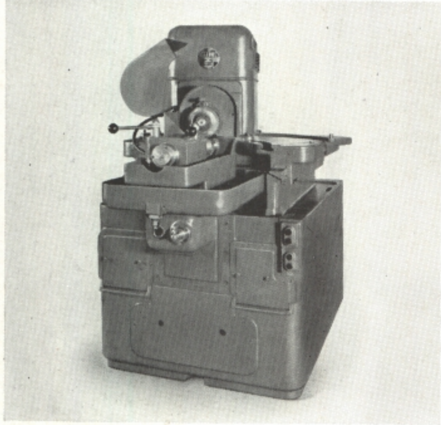
Maximum Capacities:	
Length of thread	12″
Outside diameter of work	4″
Pitch, 5/8″ linear, 5 diametral	
Helix angle	15°
Minimum pressure angle	14½°



NO. 4 FINE-PITCH GEAR SHAVING MACHINE

For Fine-pitch External Spur and Helical Gears

Maximum Capacities:	
Pitch diameter	4″
Diametral pitch	20
Face width	1″
Included angular movement of tool head	40°

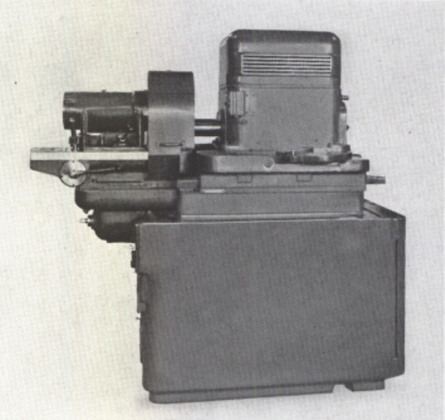


NO. 8 GEAR SHAVING MACHINE

For External and Internal Spur and Helical Gears

Maximum Capacities:	
Pitch diameter	8″
Outside diameter of work	8⅝″
Face width	2½″
Diametral pitch	4

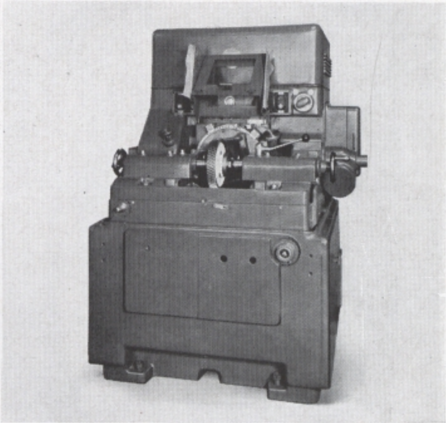
Internal gears handled with special fixture.



NO. 11 INTERNAL GEAR SHAVING MACHINE

For Internal Gears Spur and Helical Only

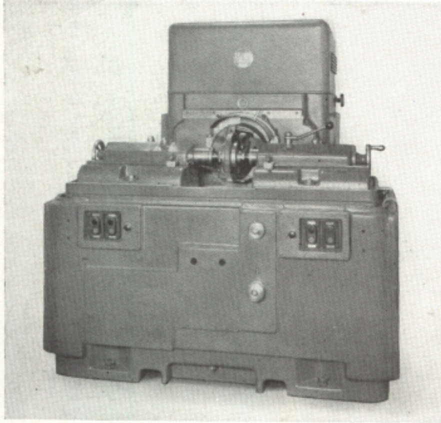
Maximum Capacities:	
Pitch diameter depends on tool and fixture	
Diametral pitch	6
Face width up to 10 pitch 1½″. 12 to 16 pitch	1″
Max. dist. top of table to C-L of spindle	9⅜″
Minimum	4⅞″



NO. 12 GEAR SHAVING MACHINE

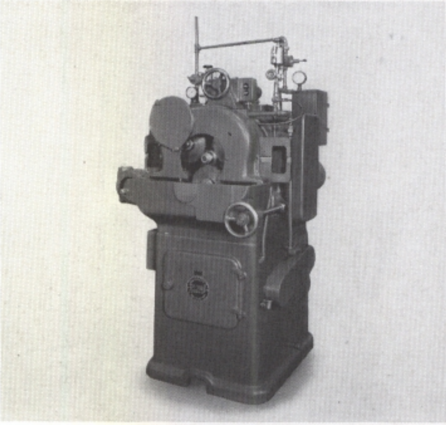
For External Spur and Helical Gears

Maximum Capacities:	
Pitch diameter	12″
Outside diameter	12½″
Face width	3″
Diametral pitch	6
Minimum pitch diameter with 7″ tool	1″



NOS. 18 & 24 GEAR SHAVING MACHINES

Maximum Capacities:	No. 18	No. 24
Pitch diameter	18″	24″
Outside diameter	18¾″	25″
Face width	5″	5″
Diametral pitch	4	4
Min. P.D. with 9½″ tool	1″	1½″

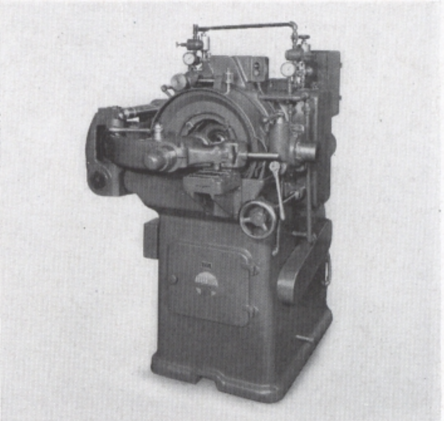


LS-TYPE GEAR LAPPING MACHINES

For External Helical Gears Only

Maximum Capacities:	7LS	10LS
Pitch diameter	7″	10″
Face width	2″	2″
Diametral pitch	6	6

Obtainable with or without adjustable lap spindles for correcting taper.



LS-TYPE GEAR LAPPING MACHINES

For External or Internal Spur and Helical Gears

Maximum Capacities:	8LS	13LS
Pitch diameter	8″	13″
Face width	2″	2″
Diametral pitch	6	6

Obtainable with or without three lap spindles for External Helical gears.

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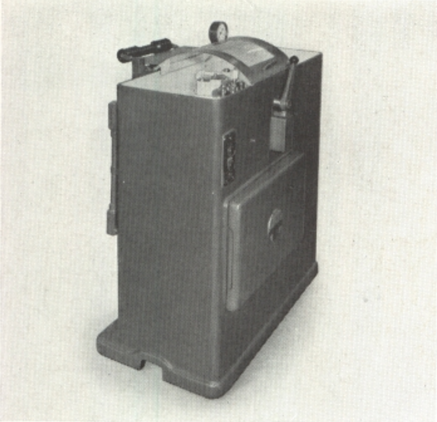
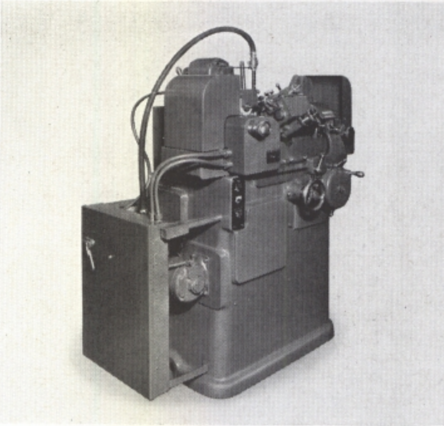


NO. 4B GEAR BURNISHING MACHINE

For Burnishing Fine-Pitch Gears

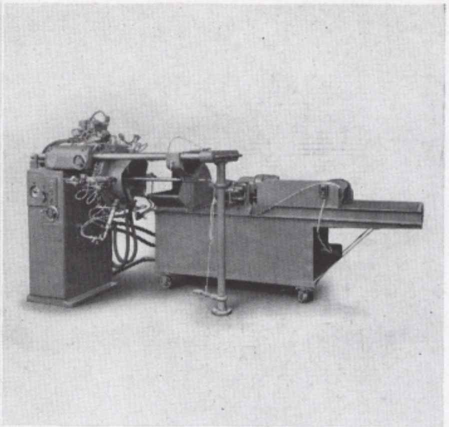
Maximum Capacities:
Pitch diameter . . . . 4″
Face width . . . . ½
Diametral pitch 16
Arranged to burnish two gears at one setting.



NO. 4S HELICAL CUTTER SHARP. MACH.

For Sharpening Normal Sharpened Helical Cutters

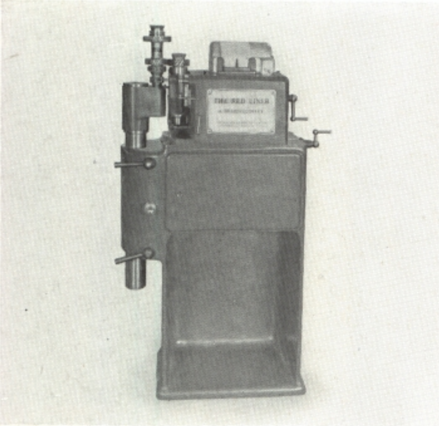
Maximum Capacities:
Maximum pitch diameter of cutter . . . . 5″
Diametral pitch . . . . ¾
Helical angle . . . . 50°
Machine is obtainable with or without automatic down feed for grinding wheel.



FLAME HARDENING MACHINE

For Local Hardening of Gears and Other Parts

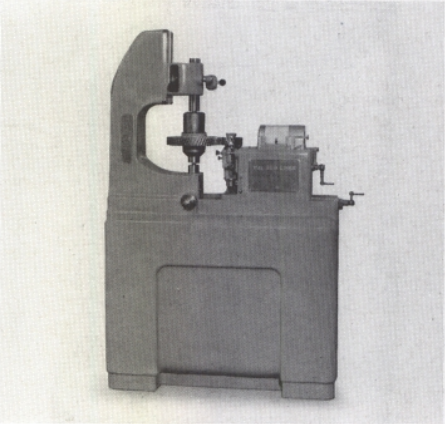
Maximum Capacities:
Outside diameter . . . . 10½″
Face width (10½″ diameter) . . . . 2″
Face width (up to 4″ diameter) . . . . 4″
Diametral pitch 4
Shaft length . . . . 36″



NO. 8M RED LINER

For Checking Spur and Helical, External and Internal Gears

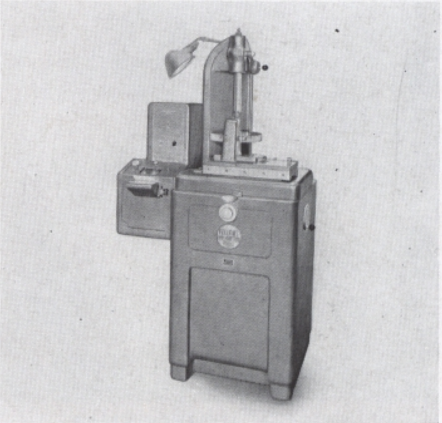
Maximum Capacities:
Pitch diameter . . . . 8″
Capacity is governed by character and shape of work, and can be greatly increased by the use of Special Fixtures.



NO. 20M RED LINER

For Checking Spur and Helical, External and Internal Gears

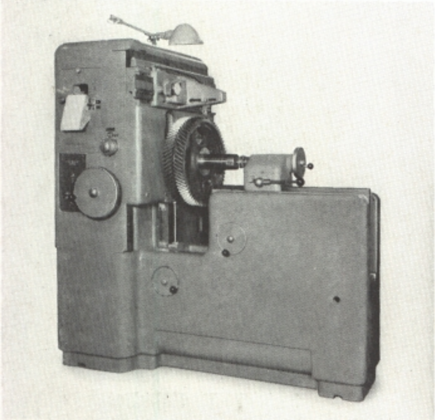
Maximum Capacities:
Pitch diameter . . . . 18″
Machine is arranged to hold work on centers, both of which are adjustable. Maximum distance between centers, 19″, Minimum 4″.



NO. 12M INVOLUTE MEAS. MACHINE

For Checking Involute Profiles

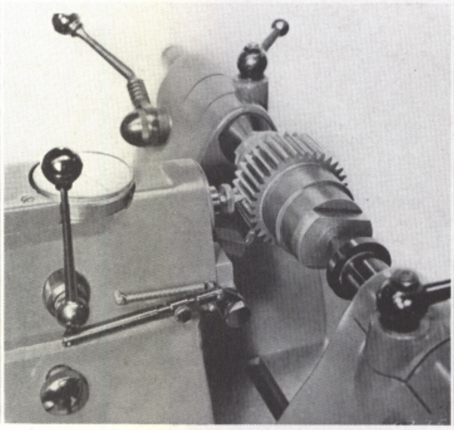
Maximum Capacities:
Pitch diameter . . . . 12″
Pointer holder movement . . . . 4″
Work-spindle movement . . . . 4″
Tailstock movement . . . . 8″
Distance between centers . . . . 17″



NO. 24M INVOLUTE MEAS. MACHINE

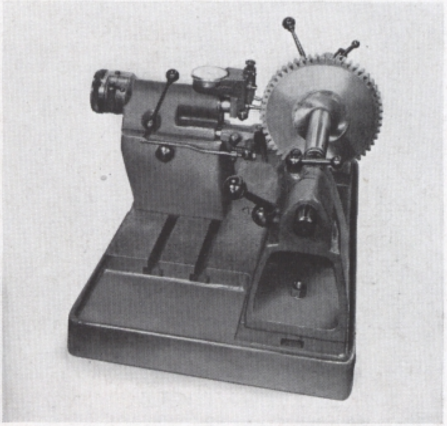
For Checking Involute Profiles

Maximum Capacities:
Pitch diameter . . . . 24″
Pointer holder movement . . . . 5″
Work-spindle movement . . . . 5¼″
Tailstock movement . . . . 24″
Distance between centers . . . . 32″



NO. 12C CONE POINT TESTING FIXTURE

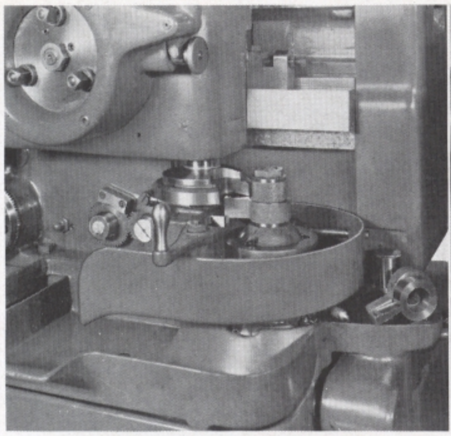
Principal Dimensions:
Maximum pitch diameter . . . . 12″
Maximum distance between centers . . . . . 15″
Overall length . . . . 28″
Overall width . . . . 18″
Measuring unit interchangeable with circular pitch testing fixture.



NO. 12CP CIRCULAR PITCH TEST. FIXTURE

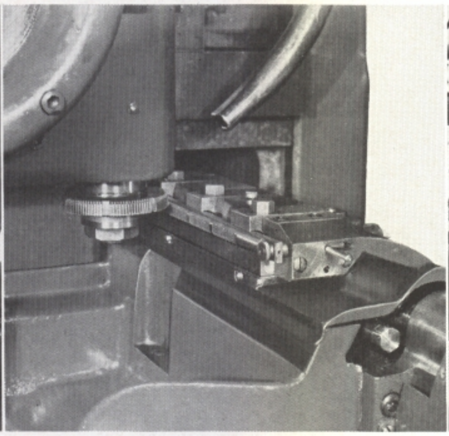
Principal Dimensions:
Maximum pitch diameter . . . . 12″
Maximum distance between centers . . . . . 15″
Overall length . . . . 28″
Overall width . . . . 16″
Measuring unit interchangeable with cone point testing fixture.

FELLOWS SPECIAL ATTACHMENTS AND TOOLS



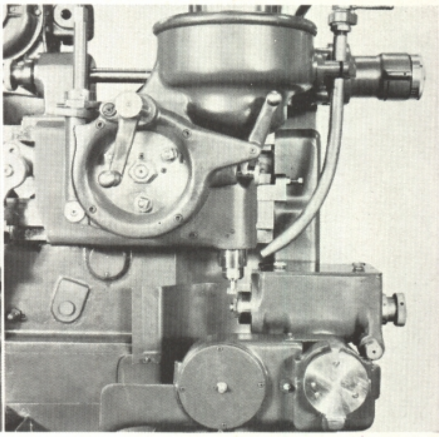
KICK-OFF AND REVERSING ATTACHMENT

With this arrangement applied to the High-speed Gear Shaper it is possible to machine parts having projections which preclude a complete rotation of the work and cutter. It is also possible to perform other operations that would ordinarily be accomplished on a milling machine.



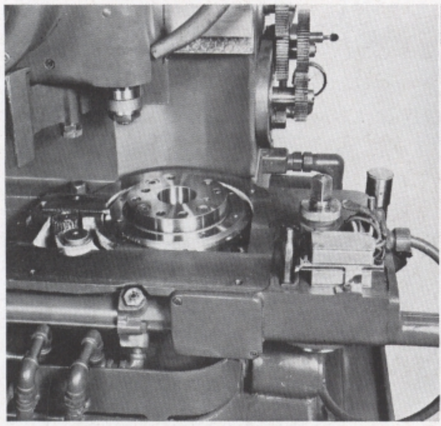
RACK CUTTING ATTACHMENT

By applying a rack-cutting attachment to the High-speed Gear Shaper it is possible to cut racks with spur or helical teeth. This fixture is arranged with a lead screw and change gears, so that racks of different pitches can be cut.



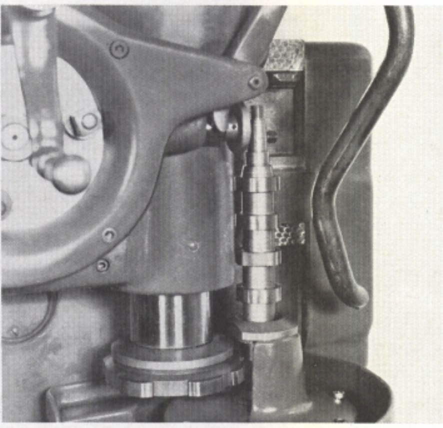
FACE GEAR CUTTING ATTACHMENT

This type of fixture converts a High-speed Gear Shaper into a machine for cutting face gears and face clutches. The machine is also provided with a side-trimming attachment, so that cutter and work can be held at standard center distance to control tooth bearing.



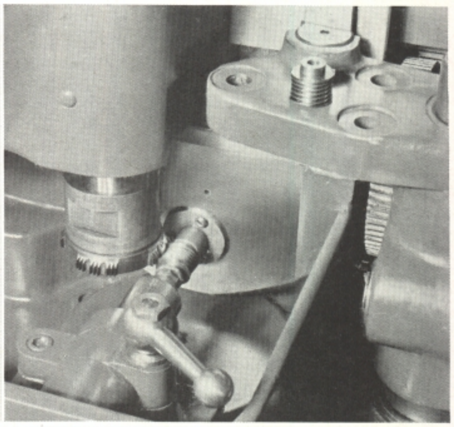
INTERMITTENT INDEXING ATTACHMENT

This special attachment converts the High-speed Gear Shaper into an automatic Indexing Slotting Machine for cutting straight-sided splines in small holes. It has the advantage that a spline can be cut into a "blind" hole.



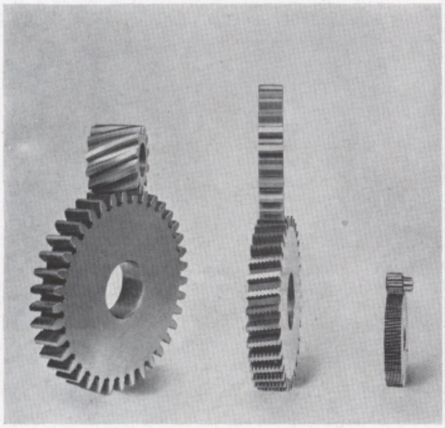
WORK ELEVATING ATTACHMENT

This attachment, combined with special electrical equipment, permits elevating and lowering the work to permit machining at various points, such as this six-lobe cam shaft for Diesel engine fuel injector pump.



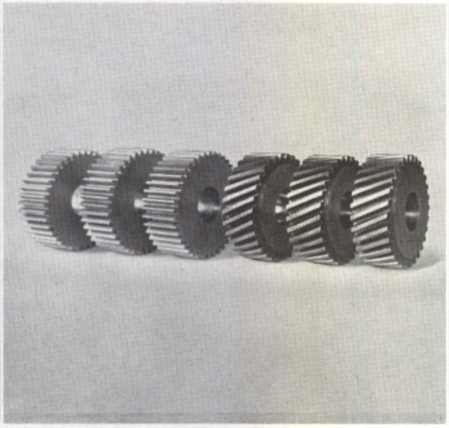
HOURGLASS WORM CUTTING ATTACHMENT

This attachment applied to a modified High-speed Gear Shaper converts it into a machine for generating small hourglass-type worms. In this case exceptional accuracy and smoothness of finish was necessary, so that cutting was divided between three groups of teeth.



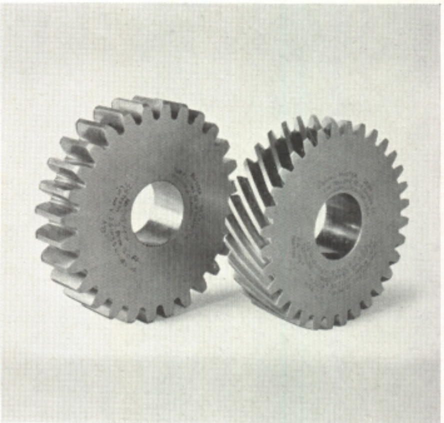
SHAVING TOOLS

Made with both spur and helical teeth for finishing helical and spur gears. Requirements vary so that all shaving tools are special.



BURNISHING GEARS

These are made with spur and helical teeth for burnishing spur and helical gears, and in two standard diameters—3 and 5 inches.



MASTER GEARS

Made in diameters from 1 to 7 inches inclusive, and in helix angles up to 45°. For use on Red Liners and Gear "Rolling" Fixtures.

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